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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/032,156	12/21/2001	M. Amin Shokrollahi	019186-003800US	3575
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TOWNSEND AND TOWNSEND AND CREW, LLP TWO EMBARCADERO CENTER EIGHTH FLOOR SAN FRANCISCO, CA 94111-3834			FAN, CHIEH M	
			ART UNIT	PAPER NUMBER
			2634	

DATE MAILED: 08/23/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/032,156

Applicant(s)

SHOKROLLAHI ET AL.

Examiner

Chieh M Fan

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 24 May 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-53 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-53 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 May 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

This Office Action is in response to the Request for Continued Examination (RCE) filed on 5/28/04.

### *Response to Arguments*

1. Applicant's arguments filed 2/27/04 have been fully considered but they are not persuasive.

The applicants argue, with respect to independent claims 1, 27 and 50, that the Wolf reference does not teach the limitation "the number of valid output symbols for a given set of input symbols is more than an order of magnitude larger than the number of input symbols" because the number of valid symbols for a given set of inputs is only the inverse of code rate in the Wolf reference, and it is impractical for Wolf to have a code rate of less than 1/10.

Examiner's response --- The examiner agrees that it may be impractical for Wolf to have a code rate less than 1/10. However, the Examiner disagrees with the argument that the number of valid symbols for a given set of inputs is only the inverse of code rate in Wolf. Wolf teaches a convolutional encoder with a code rate of 1/N. That is, Wolf teaches a convolutional encoder that encodes each input bit into N bits (col. 6, lines 47-48). As shown in Fig. 2 of Wolf, the convolutional encoder 28 receives data from the RS encoder 24. In one embodiment, Wolf shows the RS encoder outputs 14-

bit data (Fig. 4) and therefore the convolutional encoder outputs  $14 \times N$ -bit data symbols. The number of possible symbols input to the convolutional encoder is therefore  $2^{14}$ , and the number of the possible or valid output symbols of the convolutional encoder is  $2^{14 \times N}$ . Since  $N$  is obviously at least two, the number of possible output symbols is at least  $2^{28}$  (= 268,435,456). On the other hand, as shown in Fig. 4 of Wolf, the input symbol is at most 10-bit. That is, the number of possible input symbols is at most  $2^{10}$  (= 1,024). The number of valid output symbols 268,435,456 is more than an order of magnitude larger than the number of input symbols 1,024. Therefore, Wolf meets the claimed limitation even when  $N$  is equal to the smallest possible value 2.

### ***Claim Rejections - 35 USC § 112***

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 9-14, 18-25, 27-49 and 51-53 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 9, the limitation "the number of possible output symbols is much larger than the number of symbols in the combined set." In lines 7-8 is indefinite because there is no quantitative definition for comparing, which renders the scope of "much larger" indefinite.

Regarding claim 18, the limitation “the number of possible output symbols is much larger than the number of symbols in the combined set.” In lines 7-8 is indefinite because there is no quantitative definition for comparing, which renders the scope of “much larger” indefinite.

Regarding claim 23, although the applicant provides written description (see paragraphs 11 and 49) to support the claimed limitation “the step of generating the plurality of output symbols is performed substantially concurrently with the step of transmitting the plurality of output symbols”, it is determined such limitation is indefinite after further review the present application. As shown in Fig. 1 of the present application, the transmit module 140 receives the output symbols from the encoder 115. Therefore, there is inherently an unavoidable time delay between the encoder 115 and the transmit module 140 regardless how fast the processes of the encoder 115 and the transmit module 140 are. That is, the steps of generating output symbols and transmitting the output symbols are sequential, not parallel. The scope of the claimed limitation cannot be determined because the examiner cannot determine how short of the time delay may be considered “substantially concurrently”.

Regarding claim 24, similar to the reason above, the scope of the claimed limitation “the step of generating the plurality of redundant symbols is performed substantially concurrently with the step of transmitting the plurality of output symbols” is indefinite.

Regarding claim 27, Claim 27 recites the limitation “the ordered set of input symbols” in line 14. There is insufficient antecedent basis for this limitation in the claim.

Regarding claim 31, the limitation “the number of possible output symbols is much larger than the number of symbols in the combined set.” In lines 10-11 is indefinite because there is no quantitative definition for comparing, which renders the scope of “much larger” indefinite.

Regarding claim 34, the limitation “the number of possible output symbols is much larger than the number of symbols in the combined set.” In lines 10-11 is indefinite because there is no quantitative definition for comparing, which renders the scope of “much larger” indefinite.

Regarding claim 36, the limitation “the number of possible output symbols is much larger than the number of symbols in the combined set.” In lines 6-7 is indefinite because there is no quantitative definition for comparing, which renders the scope of “much larger” indefinite.

Regarding claim 45, the limitation “the number of possible output symbols is much larger than the number of symbols in the combined set.” In lines 7-8 is indefinite because there is no quantitative definition for comparing, which renders the scope of “much larger” indefinite.

### ***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

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(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-3, 6, 7, 26, 27, 30, 32 and 50 are rejected under 35 U.S.C. 102(b) as being anticipated by Wolf (U.S. Patent No. 5,983,383).

Regarding claim 1, Wolf teaches a method of encoding data for transmission from a source to a destination over a communications channel, the method comprising:

arranging data to be transmitted into an ordered set of input symbols (2, 36 in Fig. 2);

generating a plurality of redundant symbols from an ordered set of input symbols to be transmitted (see 24 and 36 in Fig. 2); and

generating a plurality of output symbols from a combined set of symbols including the input symbols and the redundant symbols (28, 30 in Fig. 2), wherein the number of valid output symbols for a given set of input symbols is more than an order of magnitude larger than the number of input symbols (28 in Fig. 2 is a convolutional encoder which adds redundant bits, the number of possible output symbols of 28 is therefore larger than the input symbols) wherein at least one output symbol is generated from more than one symbol in the combined set of symbols and from less than all of the symbols in the combined set of symbols (28 in Fig. 2 receives data from the 1st interleaver 26, which interleaves more than one input symbol and one redundant symbols), such that the ordered set of input symbols can be regenerated to a desired degree of accuracy from N of the output symbols that are determined to be valid output symbols (108, 110, 112 in Fig. 5; as shown in Fig. 5, the viterbi decoder 108 receives

the output symbols from the 1st de-interleaver 106, which in turn receives a plurality of output symbols in order to de-interleave).

Regarding claim 2, the plurality of output symbols of Wolf are transmitted over a communication channel (10, 12 in Fig. 1).

Regarding claim 3, Wolf teaches that the output symbols are stored in the interleaver 30 in Fig. 2 (an interleaver stores its input data in rows and reads out the data in columns, see col. 6, lines 40-42).

Regarding claims 6 and 7, as shown in Fig. 4 of Wolf, the number R of the redundant (i.e., parity) symbols varies according to the number K of input (i.e., information) symbols. The number K is variable, and is determined by a control processor (col. 6, lines 33-38 and 62-65).

Regarding claim 26, Wolf teaches that the step of generating the plurality of output symbols is performed using a convolutional encoder 28 (i.e., first device), and the step of generating a plurality of redundant symbols is performed by a Reed-Solomon encoder 24 (i.e., second device) separated from the convolutional encoder.

Regarding claim 27, Wolf teaches a system of encoding data for transmission from a source to a destination over a communications channel, the system comprising:

A static encoder (24 in Fig. 2) coupled to receive a plurality of input symbols, the plurality of input symbols generated from data to be transmitted (2 in Fig. 2), the static encoder (24 in Fig. 2) including a redundant symbols generator that generates a plurality of redundant symbols based on the input symbols (24 in Fig. 2 is a Reed

Solomon encoder, which generates a plurality of redundant symbols, i.e., parity, based on the input symbols); and

A dynamic encoder (28, 30 in Fig. 2) coupled to receive the plurality of input symbols and the plurality of redundant symbols, the dynamic encoder including an output symbol generator that generates a plurality of output symbols from a combined set of symbols including the input symbols and the redundant symbols, wherein the number of valid output symbols for a given set of input symbols is more than an order of magnitude larger than the number of input symbols (28 in Fig. 2 is a convolutional encoder which adds redundant bits, the number of possible output symbols of 28 is therefore larger than the input symbols) wherein at least one output symbol is generated from more than one symbol in the combined set of symbols and from less than all of the symbols in the combined set of symbols (28 in Fig. 2 receives data from the 1st interleaver 26, which interleaves more than one input symbol and one redundant symbols), such that the ordered set of input symbols can be regenerated to a desired degree of accuracy from N of the output symbols that are determined to be valid output symbols (108, 110, 112 in Fig. 5; as shown in Fig. 5, the viterbi decoder 108 receives the output symbols from the 1st de-interleaver 106, which in turn receives a plurality of output symbols in order to de-interleave).

Regarding claim 30, Wolf also teaches a transmit module (32 in Fig. 2) coupled to the dynamic encoder (28, 30 in Fig. 2).

Regarding claim 32, Wolf also teaches a key generator ("code rate select" in Fig. 3) for the static encoder 924 in Fig. 2).

Regarding claim 50, Wolf teaches a computer data signal embodied in a carrier wave comprising:

A plurality of output symbols (output of 28 in Fig. 2), wherein the plurality of output symbols represents symbols generated from a combined set of symbols including an ordered set of input symbols (2 in Fig. 2) and redundant symbols (24 in Fig. 2), wherein the redundant symbols are generated from the input symbols (24 in Fig. 2 is a Reed Solomon encoder, which generates a plurality of redundant symbols, i.e., parity, based on the input symbols), wherein the number of valid output symbols for a given set of input symbols is more than an order of magnitude larger than the number of input symbols (28 in Fig. 2 is a convolutional encoder which adds redundant bits, the number of possible output symbols of 28 is therefore larger than the input symbols), wherein at least one output symbol is generated from more than one symbol in the combined set and from less than all of the symbols in the combined set of symbols (28 in Fig. 2 receives data from the 1st interleaver 26, which interleaves more than one input symbol and one redundant symbols); such that a receiver of the data signal can regenerate the ordered set of input symbols to a desired degree of accuracy from N of the output symbols (108, 110, 112 in Fig. 5; as shown in Fig. 5, the viterbi decoder 108 receives the output symbols from the 1st de-interleaver 106, which in turn receives a plurality of output symbols in order to de-interleave).

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 4, 5, 15-17, 28 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wolf (US Patent 5,983,383).

Regarding claims 4, 5, 28 and 29, Wolf teaches the claimed invention (see the rationale applied to claims 1 and 27 above), but does not specify whether the N is greater or less than the number of input symbols in the ordered set of input symbols. However, since both situations are claimed in claims, the claimed limitations appear to be only design options, dictated by the system requirement and the user's need. The number of the input symbols depends on the amount of information to be transmitted and the number N depends on the degree of interleaving in the interleaver of West. Both numbers clearly may be selected according to the system's requirement and the user's need and do not impact the operation of Wolf.

Regarding 15-17, claims 15-17 are directed to "the desired accuracy", which is only a matter of design choice depending on the user's need. The desired accuracy only changes the process of recovering the data according to the user's need at the receiving end. It will not change the operation of West's method of encoding data for transmission, which is performed at the transmitting end. It would have been obvious to a user to select any desired accuracy to meet the user's need.

8. Claims 8 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wolf (US Patent 5,983,383) in view of Dillon et al. (US Patent 6,430,233).

Wolf teaches the claimed invention, see the rationale applied to claims 1 and 27 above, but fails to teach that the plurality of redundant symbols is generated according to a LDPC code (Wolf teaches the plurality of redundant symbols is generated according to a Reed-Solomon code). However, both LDPC code and Reed-Solomon are well known and widely used in the art for forward error correction. Dillon et al. teaches using a LDPC code or Reed-Solomon code as an error correction code (claim 47). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to generate the plurality of redundant symbols is generated according to a LDPC code so as to improve the reliability of communication.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chieh M Fan whose telephone number is (703) 305-0198. The examiner can normally be reached on Monday-Friday 8:00AM-5:30PM, Alternate Fridays off.

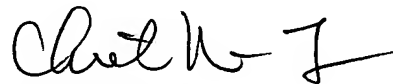
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephen Chin can be reached on (703) 305-4714. The fax phone numbers

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for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and (703) 872-9306 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-4750.



Chieh M Fan  
Primary Examiner  
Art Unit 2634

cmf  
August 17, 2004